APC 3Phase Power Distribution

North American

3 Phase Business Development Team

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Objectives

- Understand the entire 3Phase power Distribution portfolio to include:
  - InfraStruXure Modular 3Ph Power Distribution
  - InfraStruXure Row-based 3Ph Power Distribution
  - MGE Room-based Power Distribution
- Understand the positioning, features and benefits to the customer for the APC 3Ph Power Distribution portfolio to include:
  - InfraStruXure Modular 3Ph Power Distribution
  - InfraStruXure Row-based 3Ph Power Distribution
  - MGE Room-based Power Distribution
- Understand the site considerations for the APC 3Ph Power Distribution portfolio to include:
  - InfraStruXure Modular 3Ph Power Distribution
  - InfraStruXure Row-based 3Ph Power Distribution
  - MGE Room-based Power Distribution

APC 3 Phase Power Distribution Portfolio

ISX Row-based

600,480,208V, transformerless

Traditional Panel Board

Included MBP

Limited Customization Options

ISX Modular

480,415,400,208V, transformerless

Hot Swap PDMs

No Customization Options

Room-based

600,480,208V, transformerless

Traditional Panel Board

Vast Customization Options

InfraStruXure™
Modular Power Distribution

- ***Safely*** expand and service without forced shutdowns
- ***Ease*** of use and much quicker Moves/Adds/Changes saves installation costs
- ***User*** configurable distribution, pre- and post-sale

- ***266kW 415V PDU Offer*** - 480:415V
  - Current market offer is more than 2X the floor space with ~half the density
  - 10X the efficiency of standard transformers
  - Higher voltage distribution means thinner cord sets to the rack, at today's skyrocketing copper cost
  - Big savings upfront
- ***144kW 208V RPP Offer***
  - Current market offer is 2X the floor space with the same power output
  - BCM, CC, Monitoring is standard
- ***72kW 208V 10U RDP Offer***
  - Current market offer is 2X the floor space with the same power output
  - BCM, CC, Monitoring is standard

Widest Offering in the market by

- Plug type
- Voltage
- power output

InfraStruXure™
Row-based Power Distribution

- ***Included Monitoring*** enables standard SNMP integration into every data center monitoring strategy
- ***Speedy Delivery and Installation*** preconfigured whips and breakers streamline install, reduce errors, and decrease installation cost

- ***150,60kW PDU Offer - 480/208:208V***
  - (2)42 pole Circuit Breaker Panels
  - Optional Branch Current Monitoring and sub-feed breakers
- ***40/80kW PDU with Maintenance Bypass Offer - 600/480/208:208V***
  - 80kW = (1) Rear mount 42 pole Panel
  - 40kW = (2) Front mount 42 pole Panels
  - Optional Branch current monitoring sub-feed Breakers
- ***60kW RPP Offer - 208/120V***
  - (2) 42 pole Circuit Breaker Panels
- ***28kW RDP Offer - 208/120V***
  - (1) 42 pole circuit Breaker Panel
  - Mounted in an SX rack

All APC PDUs feature NEMA TP-1 rated transformers

Room-based Power Distribution

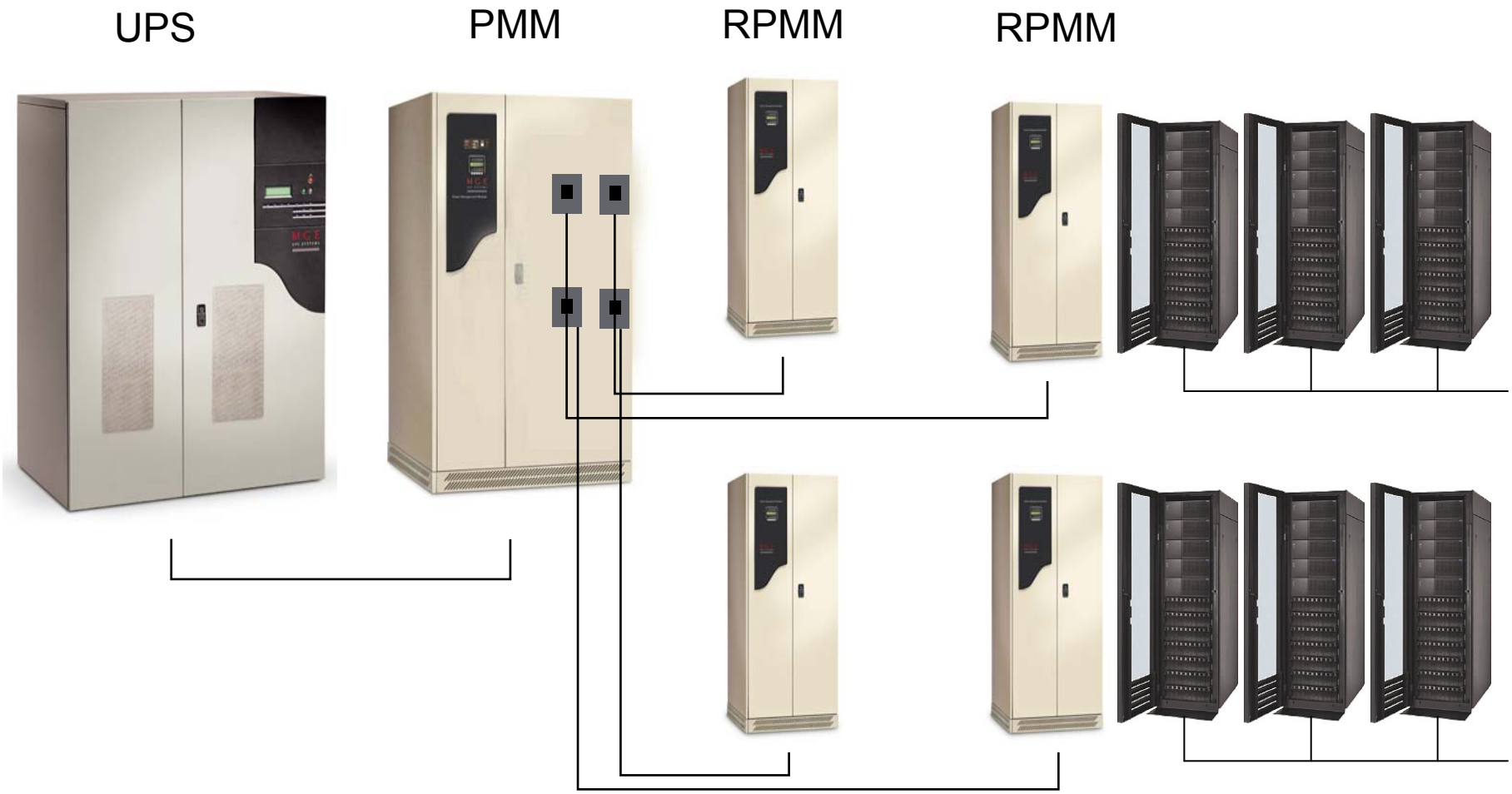
- ***Integrated isolation*** with electronic grade grounding, and distribution in a completely self contained, single enclosure.
  - Max 252 output breakers (PMM)
  - Max 168 output breakers (RPMM)

- ***480:208V PDU Offer 30, 50, 75, 100,125, 150, 200,225,300 kVA PMM***
- ***600:208V PDU Offer 50, 75, 125,150,225 kVA PMM***
- ***208:208V PDU Offer 30,50,75,100kVA PMM***
  - (2) 42 Pole Panels in a 42” Cabinet
  - Options
    - (4) additional panels
    - 15”/30” front facing
    - 13.8” side facing cabinet
    - 4 distribution breakers
    - MGE PMM Ultra - adds Epsilon STS

- ***RPP Offer - 208V RPMM***
  - (2) 42 Pole Panels in a 30” Cabinet
  - 2 additional panels added back-to-back
  - Options
    - Input/Line side Metering (PMM)
    - Main Circuit Breaker Monitoring
    - Output/Load side Metering
    - Branch Current Monitoring (50A max)
    - Integrated Harmonic management (PMM)

All APC PDUs feature NEMA TP-1 rated transformers

Room- Based Power Distribution



3 Phase Power Distribution Positioning

- Modular
  - Hot Swap PDMs
  - Safety without forced Shutdowns
  - Efficiency through the use of Higher voltages
- Row Based
  - Speed of installation
  - Traditional circuit breakers
  - Clean Data Center Aesthetic
- Room Based
  - High Pole Counts
  - Specialized plug types
  - Lower upfront cost

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Sales Tools

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High Efficiency AC vs. DC Power Distribution - WP 127

Overall Power Path Efficiency Comparison

The overall efficiency of the power path is the product of the efficiencies of the UPS, the distribution wiring, and the IT power supply given above. This is a simple calculation, as shown in **Table 2**:

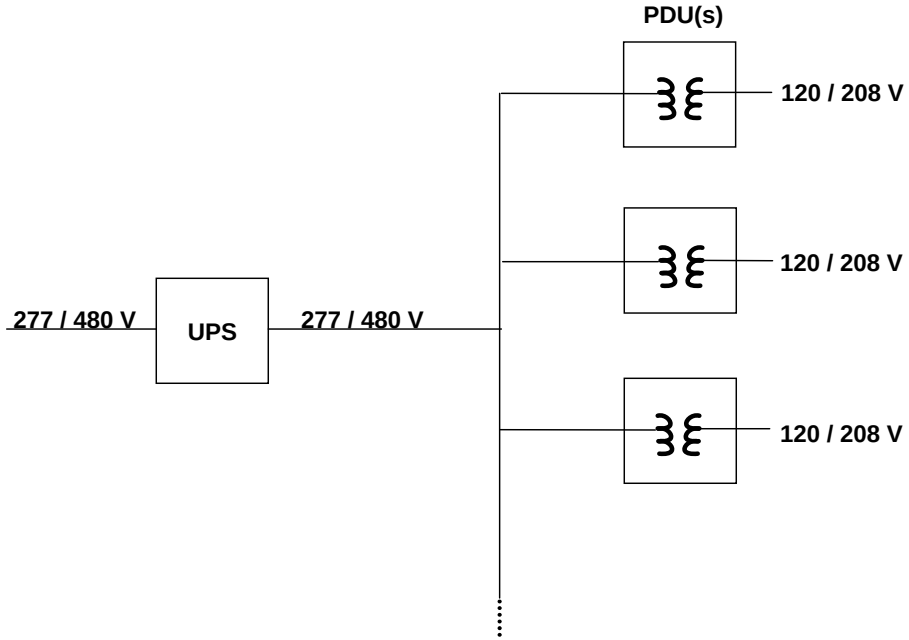
Table 2 – Overall power distribution efficiency calculation at 50% load comparing high efficiency AC and 360 V DC distribution methods

	UPS		Distribution Wiring		IT Power Supply		OVERALL EFFICIENCY
DC	96.0 %	X	99.5 %	X	91.75 %	=	87.64 %
AC	96.2 %	X	99.5 %	X	90.25 %	=	86.39 %

1.25%

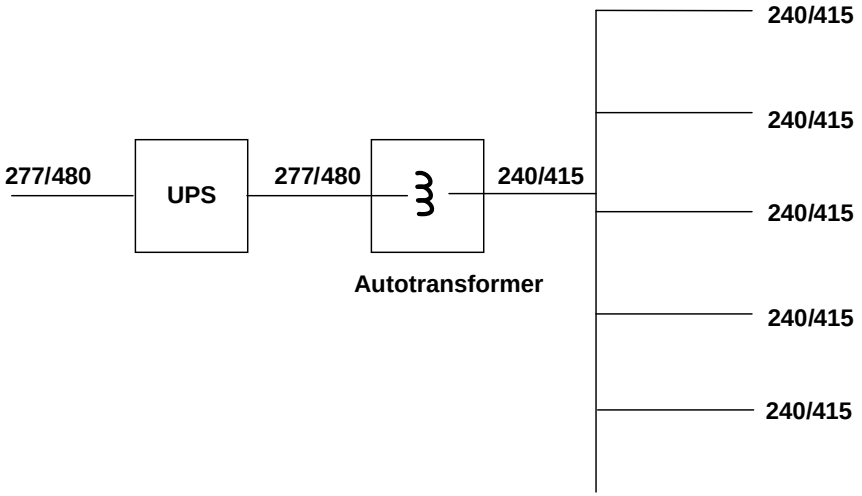
Higher Voltage AC Power Distribution - WP 128

480:208V



One-line diagram showing standard power distribution system for North American data centers

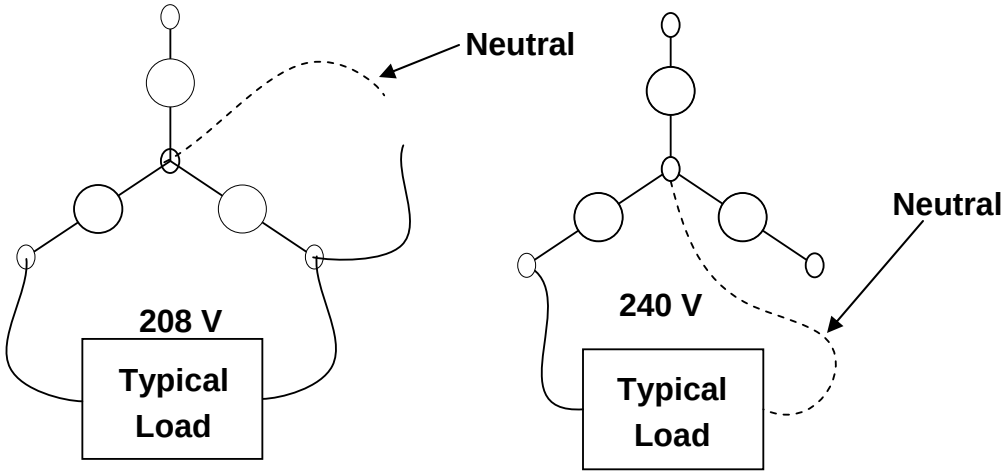
480:415V



One-line diagram showing alternative power distribution system for North American data centers

3 Transformers replaced with 1 Auto transformer

Single Phase Voltages

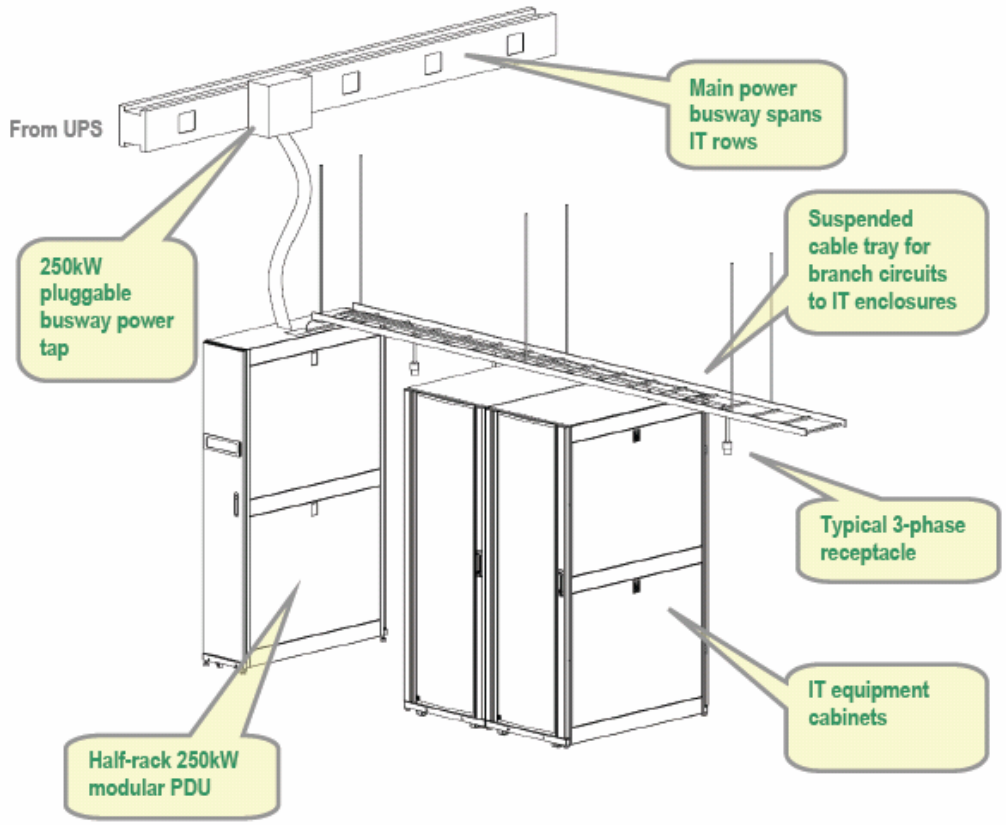


- Servers draw their power from the 208 V high voltage (line to line) connection in North America
  - They draw their power from the 230 V low voltage (line to neutral) connection in almost every other country
  - comparison should be between 120 V and 240 V and NOT between 208 V and 240 V.

- Assume 20 amp circuits are provided to the load in either case.
  - 120 V “line to neutral” distribution method is calculated as (20 amps x 120 V x 3 = 7.2 kW
  - 240 V “line to neutral” distribution method is calculated as (20 amps x 240 V x 3 = 14.4 kW).
  - 240 V distribution provides 100% more power than the 120 V distribution.

Scalable, Reconfigurable, Efficient Power Distribution - WP 129

Figure 4 – Illustration of a modular power distribution system


From UPS
Main power busway spans IT rows
Suspended cable tray for branch circuits to IT enclosures
250kW pluggable busway power tap
Typical 3-phase receptacle
IT equipment cabinets
Half-rack 250kW modular PDU

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Modular Products and HACS AN-151

APC

APPLICATION NOTE #151

InfraStruXure RPP Modular Power Distribution Unit: Hot Aisle Containment Application Guidelines and In Row Baying Instructions

Abstract

The 300-mm Remote Power Panel (RPP) Modular Power Distribution Unit (MPDU) (Only PDPM277H 400V EMEA/APJ/GCN and PDPM144F 208V NAM) is the power source for Rack Mounted Distribution Units and IT loads. As illustrated in **Figure 1**, it houses the hot-pluggable power backplane, monitoring bus, controller, Web card and the support structure for the Power Distribution Modules. Specially designed offset brackets ship with the unit to allow joining to other InRow® products and racks in the row or in a Hot Aisle Containment System (HACS) configuration. HACS door frame configurations do not allow the 300-mm RPP to be located at the end of the aisle.

Figure 1 – 300-mm RPP Modular Power Distribution Unit

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Site Considerations

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415V Site Considerations

- **Any** 480V output UPS with a 5 wire output can feed the Modular PDU.
  - Symmetra PX 250/500 has an integrated 480V sub-feed panel that is optimized for this type of application.
- **Neutral** must be provided from the building service entrance, through the UPS, due to the autotransformer technology implemented.
  - Autotransformer technology possesses only one set of windings, and does not develop or derive a neutral.
  - UL requires all UPS sub-feed wiring to be contained in the same conduit.
  - Each PDU feed will have 5 Wires (3 phases, Neutral, and Ground).
- **C13/C19** input cords are acceptable for rack loads
  - This voltage product will not support L5-20/L6-30 corded equipment.
- **42-inch** rear clearance is required for the PDU
  - This product is not compatible with the current Hot-Aisle Containment System (HACS)
  - Custom 48” roof tile adapters for HACS are available thru CEG
  - A solution for 36” hot aisle applications is under development

208V Modular RPP site considerations

- What Can I Feed From These Units?
  - **ISX 80**
    - PDPM144F/PDPM72F5U fed from 225A or 150A sub-feed breaker
  - **PD150G6F**
    - PDPM144F/PDPM72F5U fed from 225A sub-feed breaker
  - **MGE PMM**
    - Four 225A sub-feed breakers for multiple PDPM144F/PDPM72F5U
    - Custom option: Two 400A sub-feed breakers
  - **208V panels with competitor's UPS/PDU**
    - Possibilities are endless…
  - **ISX 100**
    - PDPM144F/PDPM72F5U fed from 225A sub-feed breaker

Backup Slides

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InfraStruXure™
Modular Power Distribution

415V Product Line

Distribution Modules

- 20A IEC309 3PH Female
- 20A IEC309 3X 1PH Female
- 20A IEC309 Male : 3X C19
- Circuit monitoring included
- Breaker position monitoring

½ Rack Power Distribution Unit (PDU)
½ Rack Remote Power Panel (RPP)

PDU
480V:415V/240Y
- 266kW @320A
- 72 Poles
- 24 Modules

RPP
400V RPP (transformerless)
- 277 kW 400A
- 72 Poles
- 24 Modules

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InfraStruXure™
208V Modular Power Distribution

Releasing Q3 2009

- Enclosure - 300mm 144kW Remote Power Panel (RPP)
  - 400A feed
  - 24 Modules
- Enclosure - 5U 72kW Rack Distribution Panel (RDP)
  - 200A feed
  - 6 Modules
- 3Ph Power Distribution modules
  - 20A L21-20
  - 30A L21-30
  - 60A IEC309
- 1Ph Power Distribution modules
  - 20A L5-20

RPP
208V RPP (transformerless)
•144 kW 400A
•72 Poles
•24 Modules

RDP
208V RPP (transformerless)
•72 kW 200A
•24 Poles
•6 Modules

3-Phase Power Distribution
Management Options

Row Based Power Distribution

Row Based Modular Power Distribution

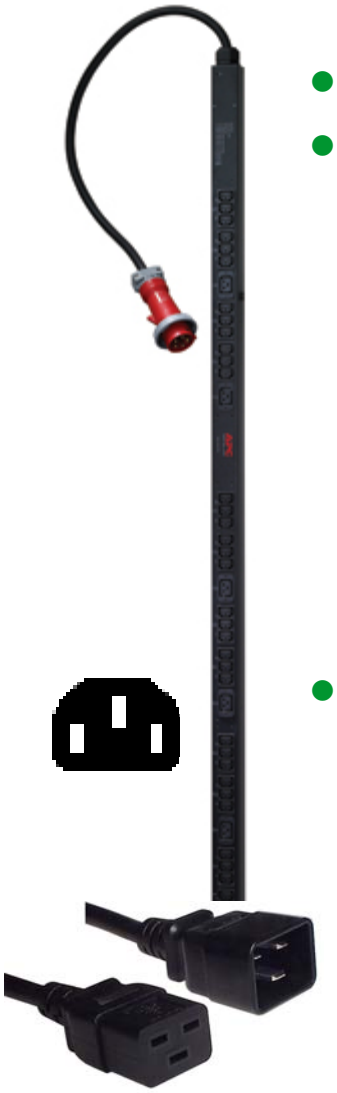
Room Based Power Distribution

- Ships with
  - **Network Management Card** – supports HTTP, HTTPS, SMTP, SNMP,SSL,TCP/IP,Telnet,WAP

Network Management Card available with environmental monitoring

- *Available options include:*
  - ***Modbus***
  - ***Ethernet (via 3rd party)***

415V NAM Data Center Applications Option 1 - Rack PDU



- 20A Breaker Module with 1 IEC309 3PH Connector
- Traditional Rack PDU applications
  - AP7557NA - The single offer is a 3Phase, Basic RPDU
  - http://apc.com/resource/include/techspec_index.cfm?base_sku=AP7557NA
  - Input: 400V 3PH, IEC 309 20A 3P+N+E , Cord Length: 3 feet (0.91 meters)
  - Output:230V
    - 36 IEC 320 C13
    - 6 IEC 320 C19

- SKUs
  - Enclosure
    - PDU - PDPM288G6H

      OR
    - RPP - PDPM277H
  - Modules - PDM3520IEC309-XXXX (Whip lengths from 80 - 1680 CM)
  - RPDU - AP7557 NA
  - AP7400 brackets for non-NetShelter Racks

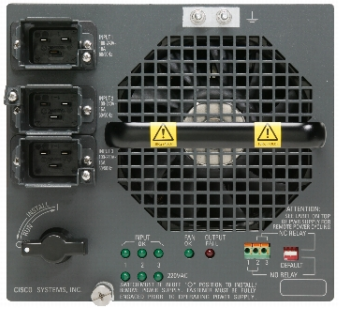
415V NAM Data Center Applications Option 2 - 200V In Row RC

- 20A Breaker Module with 3 IEC309 1PH Connectors
- 200V InRow RC
  - ACRC103 http://apc.com/resource/include/techspec_index.cfm?base_sku=ACRC103
  - Input -
    - 200V, 1380 Watts, 50/60 Hz
    - IEC 309 16A 2P+E

- SKUs
  - Enclosure
    - PDU - PDPM288G6H

    OR
    - RPP - PDPM277H Modules
  - Modules
    - PDM1320IEC-3P-1 (260, 380, 500cm Whips)
    - PDM1320IEC-3P-2 (680, 860, 1040cm Whips)
    - PDM1320IEC-3P-3 (1680, 1680, 1680cm Whips)
  - InRow RC - ACRC103

415V NAM Data Center Applications Option 3 - Directly Connect 240V Servers



Cisco Catalyst 6500 Series Switches

- 20A Breaker Module with 1 IEC309 3PH Connector
- Utilize “Calamari Plug” to directly power rack equipment
  - Input - 1 IEC 309 3PH 20A Male Plug
  - Output - 3 C19

- SKUS
  - Enclosure
    - PDU - PDPM288G6H

      OR

    - RPP - PDPM277H
  - Modules
    - PDM3520IEC309-XXXX (Whip lengths from 80 - 1680 CM)
  - Calamari Plug - PDX520IEC309L-3C19

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415V NAM Data Center Applications
Option 4 - Calamari to 1U Rack PDU

- 20A Breaker Module with 1 IEC309 3PH Connector
- Utilize “Calamari Plug” to directly power rack equipment
  - Input - 1 IEC 309 3PH 20A Male Plug
  - Output - 3 C19

- SKUS
  - Enclosure
    - PDU - PDPM288G6H

      OR
    - RPP - PDPM277H
  - Modules
    - PDM3520IEC309-XXXX (Whip lengths from 80 - 1680 CM)
  - Calamari Plug - PDX520IEC309L-3C19
  - 1U Rack PDU
    - AP9565 - basic
    - AP7921 - switched

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Technical Specifications

	PMM	RPMM
kVA Range	30-300 kVA	N/A
Input Voltage	208/480/600V	208V
Output Voltage	208/120V	208/120V
Panelboards	Standard: 2 x 42 Pole Option: Up to 6 (total 252 Poles)	Standard: 2 x 42 Pole Option: Up to 4 (total 168 Poles)
Configuration	Front Facing / Side Facing Aux Cabinets	Side-to-Side / Back-to-Back Aux Cabinet
K20 Rated Isolation Transformer	Yes	No
Panelboard Main Circuit Breaker	Yes	Yes
200% Rated Neutral Bus	Yes	No
Local EPO	Yes	No
Cable Entry	Top/Bottom	Top/Bottom

Options/Accessories

	PMM	RPMM
Circuit Breakers to Populate Panelboards	Square D Type Bolt-On/plug-in	Square D Type Bolt-On/plug-in
Submain Circuit Breakers	4 x 225A	No
Harmonic Cancellation Transformer	Yes	N/A
Monitoring / Metering	MCM / PM800 / CM4000 / DMMS300	MCM / PM800
Branch Circuit Current Monitoring	With MCM Monitor	With MCM Monitor
Panelboard Main CB Current Monitoring	With MCM Monitor	With MCM Monitor
TVSS	Internal	No
Panelboard Isolated Ground Bus	Yes	Yes
High Interrupting (KAIC) Main Input CB	Yes	N/A
Input Junction Box	Yes	Yes
Manual Restart	Yes	No
Remote EPO	Yes	No
Transient Suppression Plate	Yes	Yes
Shunt Trip	No	Yes
Floor Stands / Seismic Brackets	Yes	Yes